NASA Facts

National Aeronautics and
Space Administration

Dryden Flight Research Center
P.O. Box 273
Edwards, California 93523
AC 805-258-3449
FAX 805-258-3566
pao@dfrc.nasa.gov

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Systems Research Aircraft in flight EC 97 44272-6

F/A-18 Systems Research Aircraft

The NASA Dryden Flight Research Center is using an F/A-18 Hornet fighter aircraft as its Systems Research Aircraft (SRA). The aircraft is on loan from the U.S. Navy.

Background

The SRA project helps ensure that new aerospace concepts are transferred quickly to the U.S. aerospace industry so they can be applied to technologies for commercial and military aircraft and space vehicles.

Key technologies investigated aboard the F/A-18 SRA include advanced power-by-wire concepts and fly-by-light (fiber optic cable) systems, as well as electric-powered actuators and advanced flight-control computer software. In the past, pilots controlled aircraft through direct force. As engine power and speeds increased, more force was needed, and hydraulically boosted control, governed by flight-control computers, emerged. Power-by-wire, fly-by-light systems and electric-powered actuators aim to eliminate cumbersome hydraulic cables in favor of more versatile wires and fiber-optic cables.

Future aircraft that will benefit from research aboard the SRA are the high-speed civil transport next-generation general aviation and military aircraft. In addition, the program is developing advanced flight-test techniques that will be used on future aircraft.

Introduction

The primary goal of the SRA program is to identify and flight-test the newest and most advanced technologies beneficial to subsonic, supersonic (faster than the speed of sound), hypersonic (more than five times the speed of sound) and space applications. The SRA facility allows government and industry to focus the integration, ground test and flight validation of breakthrough technologies.

The ability to flight-test new technologies can eliminate perceived and real technical barriers. The systems testbed approach used by the SRA facility lowers development cost, decreases the time needed to develop new technologies and focuses research efforts.

The program fulfills several goals of NASA Aeronautics and Space Transportation Technology, including increased aviation safety, improved environmental compatibility and cheaper access to space.

Flight Research Programs

Electrically Powered Actuation Design Validation Program (EPAD) — The purpose of the EPAD program is to examine the reliability and performance of advanced actuators. An actuator translates signals from the aircraft's flight controls to a mechanical action of control surfaces such as flaps, ailerons and rudders. The EPAD program is a joint effort by NASA, the U.S. Air Force and U.S. Navy. Two actuators, the Smart Actuator and the Electro-Hydrostatic Actuator have been tested successfully aboard the SRA. The third actuator in the program, the Electro-Mechanical Actuator, arrived at Dryden in October 1997. The Electro-Mechanical Actuator could significantly reduce the costs and logistical and maintenance support for future aircraft by helping eliminate sophisticated but heavy aircraft hydraulic systems in favor of electrical "power-by-wire" systems for operating flight controls. Besides savings in cost and support, electrical systems promise diminished vulnerability in combat by eliminating hydraulic lines in the fuselage and wing box. The experiment is slated to begin flight-research missions in March 1998 after ground-based testing.

Schlieren Imaging System Experiment —The Schlieren Imaging System experiment uses two F-18s, one "chase" aircraft outfitted with a special airborne camera system and Dryden's F/A-18 SRA, which acts as a "target" aircraft. As the F/A-18 SRA passes at supersonic speeds in front of the sun, its shock waves, which are more dense than the surrounding air, are illuminated. The F/A-18 with the Schlieren Imaging System can record these shock waves using the system's optics and imaging camera that are located in a modified NITE Hawk Forward Looking Infrared pod. This pod provides the stability and tracking required for Schlieren imaging. Studying images of shock waves has several potential applications: allowing researchers to reduce the effects of sonic booms on the ground, verifying and enhancing wind tunnel studies and computational techniques that predict the structure and movement of shock waves and observing the interactions of aircraft engine exhaust/ plume shocks that can have a negative impact on engine acoustics or performance. Imaging flights are scheduled to begin in early 1998.

Air-to-Air Global Positioning System — To perform the carefully choreographed Schlieren experiment, the F/A-18 SRA and Dryden's F-18 no. 846 will use a new air-to-air global positioning system (GPS). The air-to-air GPS system consists of a GPS receiver and modem in each aircraft for data communications between the F-18s. F-18 No. 846, the "chase" aircraft, processes information in its receiver, calculates the real-time relative positions of the two aircraft, and displays these positions for the pilot. This provides precise information about the position of the SRA "target" aircraft, which is necessary for the Schlieren imaging. Air-to-air GPS also has valuable applications where precise information about the relative positions of aircraft might be necessary. Possible uses include close formation flight and vortex flow surveys behind aircraft. Early flight-research missions have shown accuracy of within 6 inches.

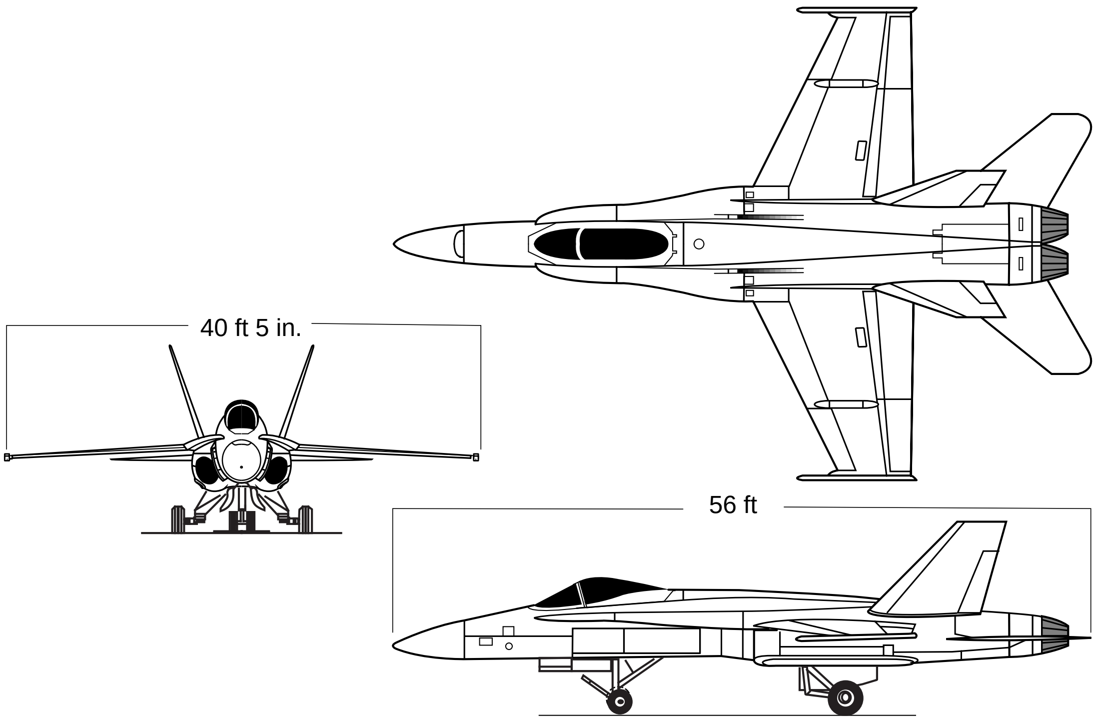
Production Support Flight Control Computer—The Production Support Flight Control Computer is slated to speed up the development of new flight-control software. Standard F-18s fly with one set of flight-control software. This new system allows the aircraft to fly using two sets of software — research flight-control software and the standard flight-control software. The aircraft will be able to fly using the research software, and if problems occur, the pilot will be able to quickly switch over to the standard flight-control software. This new capability will speed up the development time for new flight-control software by shortening the amount of validation and verification time spent on the ground before it is installed and flown on the aircraft. The Production Support Flight Control Computer underwent a combined systems test in December 1997, and is scheduled to fly in March 1998.

Program Management

Dryden's Systems Research Aircraft program is a joint effort between Dryden and NASA's Langley and Lewis Research Centers. Also participating are the U.S. Air Force and Navy.

The SRA has been developed from a pre-production model of the F/A-18, a two-seat fighter/attack aircraft built by Boeing, formerly McDonnell Aircraft Co., St. Louis, Mo. The F/A-18 is currently in service with the U.S. Navy and Marine Corps.

Aircraft Specifications



Three view of F/A-18 Systems Research Aircraft

The aircraft has a wing span of 40 feet five inches The fuselage is 56 feet long and 10 feet six inches high at the canopy.

The SRA is powered by two General Electric F-404-GE-400 turbofan engines, each producing 16,000 pounds of thrust in afterburner.

Typical takeoff weight of the SRA is 39,000 lb, with 10,000 pounds of internal fuel.

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